Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MIS036-P37 Room:Convention Hall Time:May 26 14:15-16:15

2011 Tohoku megathrust earthquake revealed by high-frequency strong ground motions

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A megathrust earthquake that struck the Tohoku region, Japan, on 11 March 2011 was closely observed by dense seismic networks. Strong-motion waveforms clearly indicated that distinct sub-events successively occurred during the earthquake. To investigate source processes of the earthquake, we utilized a source location method using high-frequency seismic amplitudes, which enables us to locate sources of continuous signals. We estimated source locations in successive time windows using strong-motion waveforms from the KiK-net, in which a frequency band of 5-10 Hz and a Q factor of 300 were used. We detected three main sub-events during total source duration of 150 s. The sources of these sub-events were located in a region near the Japan Trench off Miyagi and Fukushima Prefectures. The first two sub-events were determined in very similar locations. The peak ground velocities at stations of KiK-net and K-NET showed strong shaking in Miyagi, Fukushima, and Ibaraki Prefectures, which is in agreement with the location of our estimated source area of high-frequency seismic radiations.